MATERIAL SAFETY DATA SHEET

National Institute of Standards and Technology
Reference Materials Program
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SRM Number: 2034 Standard
MSDS Number: 2034
SRM Name: Holmium Oxide Wavelength Standard

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SECTION I. MATERIAL IDENTIFICATION

Material Name: Holmium Oxide Wavelength Standard

Description: SRM 2034 is an aqueous solution prepared in 10 % (volume fraction) perchloric acid ($HC1O_4$) to contain 4 % (mass fraction) holmium oxide (Ho_2O_3). The solution is contained in a flame-sealed, nonfluorescent, fused silica cuvette of optical quality. A protective cap is glued over the fused end of the cuvette.

Other Designations: Holmium Oxide (diholmium trioxide; holmia; holmium sesquioxide; holmium trioxide)/**Perchloric Acid** (dioxonium perchlorate; perchlorate solution; hydronium perchlorate)

Name	Chemical Formula	CAS Registry Number
Perchloric Acid	$HClO_4$	7601-90-3
Holmium Oxide	Ho_2O_3	12055-62-8

DOT Classification: Corrosive and Oxidizer, UN1760; Packing Group II

SECTION II. HAZARDOUS INGREDIENTS

Hazardous Component	Nominal Concentration (%)	Exposure Limits and Toxicity Data
Perchloric Acid	10	LD_{50} (Rat, Oral): 1100 mg/kg
		LD_{50} (Mouse, Subcutaneous): 250 mg/kg
		LD_{50} (Dog, Oral): 400 mg/kg
Holmium Oxide	4	LD_{50} (Rat, Oral): $>$ 1000 mg/kg

SECTION III. PHYSICAL/CHEMICAL CHARACTERISTICS

Perchloric Acid	Holmium Oxide
Appearance and Odor: a colorless liquid with no odor	**Appearance and Odor:** an off-white to orange color, hygroscopic material with no odor
Relative Molecular Mass (g/mol): 100.46	**Relative Molecular Mass (g/mol):** 377.86
Density (g/mL): 1.6	**Density (g/mL):** 8.40
Solubility in Water: soluble	**Solubility in Water:** insoluble
Solvent Solubility: not available	**Solvent Solubility:** soluble in inorganic acids

NOTE: The physical and chemical data provided are for solutions of 60 % perchloric acid and pure holmium oxide. The actual behavior of the solution may differ from the individual components.

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not Applicable **Method Used:** Not Applicable **Autoignition Temperature:** Not Applicable

Flammability Limits in Air (Volume %): **UPPER:** Not Applicable
LOWER: Not Applicable

Unusual Fire and Explosion Hazards: Perchloric acid and holmium oxide are negligible fire hazards when exposed to heat or flame. Both perchloric acid and holmium oxide are oxidizers; they may ignite or explode on contact with combustible materials.

Extinguishing Media: Use regular dry chemical, carbon dioxide, water or regular foam.

Special Fire Procedures: Fire fighters should wear a self-contained breathing apparatus (SCBA) with a full face shield in the pressure demand or positive mode and other protective clothing.

SECTION V. REACTIVITY DATA

Stability: **__X__ Stable** **____ Unstable**

Conditions to Avoid: Avoid contact with combustible and other incompatible materials. Perchloric acid may explode if exposed to shock, friction or heating. It may react with evolution of heat on contact with water. It may decompose violently at room temperature.

Incompatibility (Materials to Avoid): Perchloric acid is incompatible with acids, combustible materials, metals, oxidizing agents, metal oxides, halo carbons, halogens, metal salts, and bases. Holmium oxide is incompatible with strong acids.

See Section IV: "Unusual Fire and Explosion Hazards".

Hazardous Decomposition or Byproducts: Hazardous decomposition of perchloric acid produces acid halides and oxides of chlorine. Thermal decomposition of holmium oxide may release toxic and/or hazardous gases.

Hazardous Polymerization: **_____ Will Occur** **__X__ Will Not Occur**

SECTION VI. HEALTH HAZARD DATA

Route of Entry: **__X__ Inhalation** **__X__ Skin** **__X__ Ingestion**

Health Hazards (Acute and Chronic): Perchloric Acid: Perchloric acid may be fatal if inhaled, swallowed, or absorbed through skin. This material causes burns and is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin. Inhalation may be fatal as a result of spasm, inflammation, and edema of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, vomiting, and diarrhea.

Holmium Oxide: Holmium oxide is harmful by inhalation, ingestion, or skin absorption. Exposure may cause irritation to skin, eyes, mucous membranes, and upper respiratory tract. Inhalation of sufficient amounts may cause itching, sensitivity to heat, an increased awareness of odor and taste, and lung damage. Other effects may include nausea and headache. Eye contact may cause conjunctival irritation.

Medical Conditions Generally Aggravated by Exposure: eye disorders, respiratory disorders, and skin disorders

Listed as a Carcinogen/Potential Carcinogen:

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens		X
In the International Agency for Research on Cancer (IARC) Monographs		X
By the Occupational Safety and Health Administration (OSHA)		X

EMERGENCY AND FIRST AID PROCEDURES:

Skin Contact: Remove contaminated shoes and clothing. Rinse affected area with large amounts of water followed by washing the area with soap and water. Watch for chemical irritations and treat them accordingly. Obtain medical assistance if necessary.

Eye Contact: Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Obtain medical assistance.

Inhalation: If inhaled, move the victim to fresh air. If breathing is difficult, give oxygen; if the victim is not breathing, give artificial respiration. Obtain medical assistance if necessary.

Ingestion: If ingestion occurs **DO NOT** induce vomiting. When vomiting occurs, keep head lower than hips to help prevent aspiration. Obtain medical assistance immediately.

TARGET ORGAN(S) OF ATTACK: skin, eyes, upper respiratory tract

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material is Released or Spilled: Do not touch spilled material. Notify safety personnel of spills. Avoid contact with combustible materials. Flood with water. Contaminated surfaces should be covered with soda ash or sodium bicarbonate to neutralize the acid. Place the neutralized material into containers suitable for proper disposal.

Waste Disposal: Follow all federal, state, and local laws governing disposal.

Handling and Storage: Store in a cool and dry place. Store in a well-ventilated area. Keep separated from incompatible substances. Protect from freezing. Provide approved respiratory apparatus for non-routine or emergency use. Wear chemical resistant gloves and splash resistant safety goggles with a faceshield. Wear appropriate chemical resistant clothing. An eye wash station and washing facilities should be readily available near handling and use areas. **DO NOT** wear contact lenses in the laboratory.

SECTION VIII. SOURCE DATA/OTHER COMMENTS

Sources: MDL Information Systems, Inc., MSDS *Perchloric Acid*, 60 %, 15 December 2003.
MDL Information Systems, Inc., MSDS *Holmium Oxide*, 19 March 2003.